

CLAIMS

What is claimed is:

1. Crosslinked microparticles of between 10 and 300 nm in size, obtained by polymerization of a composition of ethylenically unsaturated polymerizable compounds, characterized in that the composition of the polymerizable compounds comprises comprising:

- a first component A representing from 50 to 99 mol% of the said composition and selected from the group consisting of isobornyl (meth)acrylate and/or, norbonyl (meth)acrylate and/or, cyclohexyl (meth)acrylate and/or, Cardura E10 (meth)acrylate and combinations thereof, optionally in combination with a C₂-C₈ alkyl (meth)acrylate
 - a second component B consisting of at least one monomer or oligomer comprising at least two ethylenic unsaturations which can undergo radical-mediated polymerization, the said monomer or oligomer being other than an allylic(meth)acrylate
 - a third component C consisting of at least one monomer or oligomer comprising, in addition to an ethylenic unsaturation which can undergo radical-mediated polymerization, at least one second reactive function f1 which is different from the ethylenic unsaturation optionally with the possibility of at least partial chemical modification of the initial functions f1 into final functions f2 under the condition that the functions f1 selected do not react with each other during the polymerization, with the sum of the components A, B and C being 100 mol%-%.
2. Microparticles according to Claim 1, characterized in that they bear 2. The microparticles of
Claim 1, wherein functions f1 borne by the component C, which are selected from the group
consisting of: epoxy, hydroxyl, carboxyl, carboxylic anhydride, isocyanate, silane, amine, oxazoline, and, where appropriate, functions f1 at least partially modified into functions f2, selected from: (meth)acrylates, vinyls, maleates, maleimides, itaconates, allylic alcohol esters,

unsaturations based on dicyclopentadiene, C₁₂-C₂₂ unsaturated fatty esters or amides, carboxylic acid salts ~~or and~~ quaternary ammonium salts.

3. ~~Microparticles according to either of Claims 1 and 2, characterized in that the The microparticles of Claim 1 wherein~~ component C is present in a molar content of between 0 and 49.5 mol% relative to the sum of the polymerizable compounds, and is selected from the group consisting of: glycidyl (meth)acrylate, C₂-C₆ hydroxyalkyl (meth)acrylates, (meth)acrylic acid, maleic acid or anhydride or fumaric acid, itaconic acid or anhydride, isocyanatoethyl (meth)acrylate, dimethylaminoethyl (meth)acrylate, and 2-(5-methacryloyl-pentyl)-1,3-oxazoline.

4. ~~Microparticles according to one of Claims 1 to 3, characterized in that the The microparticles of Claim 1 wherein~~ component B is selected from multifunctional (meth)acrylate monomers of functionality ranging from 2 to 6, substituted or unsubstituted divinylbenzenes and/or multifunctional (meth)acrylic ester oligomers or unsaturated polyesters of functionality ranging from 2 to 50 and with an a number average molecular weight Mn of less than 2500.

5. ~~Microparticles according to one of Claims 1 to 4, characterized in that The microparticles of Claim 1 wherein~~ the composition of the polymerizable compounds comprises:

- 50 to 95 % mol% of a component A selected from the group consisting of isobornyl (meth)acrylate and/or, norbonyl (meth)acrylate and/or, butyl (meth)acrylate and combinations thereof

- 0.5 to 10 % mol% of a component B consisting of at least one monomer and/or oligomer selected from:

- di(meth)acrylates of: ethylene glycol, propylene glycol, butanediol, 2-methylpropanediol, neopentyl glycol, hexanediol, diol oligomers with an Mn of less than 2500, preferably polyethers, polyesters or polyurethanes

- substituted or unsubstituted divinylbenzenes
 - unsaturated polyester oligomers or acrylated acrylic oligomers with an Mn of less than 2500

and having a number of ethylenic unsaturations per mole of from 2 to 50

- not more than 49.5 mol% of a component C consisting of at least one monomer and/or oligomer selected from:

- (meth)acrylic acid, maleic, fumaric or itaconic acid, when f1 is a carboxyl function;

- maleic anhydride or itaconic anhydride when, f1 is a carboxylic anhydride function;

- hydroxyalkyl (meth)acrylates containing a C₂C₆ alkyl or mono (meth) acrylates of polyether or polyester or polyurethanediol or polycaprolactone oligomers with and an Mn of less than 1500, when f1 is a hydroxyl function;

- glycidyl (meth)acrylate, (meth)acrylates of epoxidized derivatives of dicyclopentadiene or epoxidized vinylnorbornene (meth)acrylates or alkoxyLATED glycidyl ether (meth)acrylates or (meth)acrylates of epoxidized derivatives of cyclohexene, when f1 is an epoxy function function;

- isocyanatoethyl (meth)acrylate and urethane mono (meth) acrylates derived from diisocyanates, when f1 is an isocyanate function;

- (meth)acrylates bearing a trialkyl or trialkoxysilane group, when f1 is a silane function;

- dimethylaminoethyl (meth)acrylate or tert-butylaminoethyl (meth)acrylate, when f1 is an amine function;

- 2-(5-(meth)acryloylpentyl)-1, 3-oxazoline, when f1 is a oxazoline function;

with the sum A + B + C being equal to 100 mol%%.

6. Microparticles The microparticles according to one of Claims 1 to 5, characterized in that they bear Claim 1 wherein f1 is carboxyl functions f1 or carboxyl hydroxyl functions f1 which are partially or totally modified into functions f2 selected from the group consisting of: (meth)acrylate and/or, vinyl

and/or, maleate and/or, fumarate and/or, maleimide and/or, carboxylic acid salt functions f2. or combinations thereof.

-40-

~~7. Microparticles according to one of Claims 1 to 6, characterized in that~~

7. ~~The microparticles of Claim 1 wherein they bear hydroxyl functions f1 or epoxy functions which are f1 possibly partially modified into (meth)acrylate functions f2.~~

8. ~~Process A process for preparing the microparticles as defined in one of Claims 1 to 7, characterized in that it comprises a step of Claim 1, the process comprising the steps of:~~

- ~~= polymerizing, via radical-mediated dispersion polymerization, in a non-aqueous medium which is a nonsolvent for the polymer formed, of a composition of polymerizable compounds as defined in one of Claims Claim 1 to 5, without any addition of a stabilizing polymer for the microparticles formed, either before, during or after polymerization, it being possible for the said process to comprise, where appropriate, an additional step of at least partial chemical modification of and optionally,~~
- ~~= chemically modifying, at least partially, the functions f1 borne by the component C as defined in one of Claims 1 to 3 and 5.~~

9. Coating or

9. ~~A coating, moulding or composite composition, characterized in that it comprises microparticles as defined in one of Claims 1 to 7. comprising the microparticles of Claim 1.~~

~~10. Composition according to Claim 9, characterized in that it is crosslinkable and consists solely or essentially of microparticles as defined in one of Claims~~

10. ~~The composition of Claim 9 consisting essentially of the microparticles of Claim 1 to 7, comprising functions f1 and/or f2 which are identical or different and which can be crosslinked between microparticles, forming at least one crosslinking network.~~

11. ~~Composition according to Claim 9, characterized in that it comprises The composition of Claim 9 comprising~~ from 0.5 to 50% by weight of ~~microparticles as defined in one of Claims 1 to 7.~~ the microparticles of Claim 1.

12. ~~Composition according to one of Claims 9 to 11, characterized in that~~

12. The composition of Claim 9 wherein the said composition is a coating composition.

13. ~~Composition~~ The composition according to Claim 12 characterized in that wherein the coating composition is a composition which can undergo radical-mediated crosslinking, comprising: (i) acrylic or vinyl mono-or

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multifunctional monomers and/or multifunctional acrylic oligomers and ~~microparticles defined according to one of Claims 1 to 7, bearing (meth)acrylate and/or maleate and/or fumarate and/or (ii) the microparticles of Claim 1 bearing f2 functions selected from the group consisting of (meth)acrylate, maleate, fumarate, maleimide functions f2 and combinations thereof, the f2 functions obtained from the at least partial modification of the starting functions f1.~~

14. ~~Composition according to Claim 12 or 13, characterized in that The composition of Claim 12 wherein~~ the coating composition is a composition which can undergo crosslinking by radiation.

15. ~~Composition according to Claim 13 or 14, characterized in that The composition of Claim 13 wherein~~ the crosslinkable composition comprises, as: (i) acrylic monomers; selected from the group consisting of: isobornyl (meth)acrylate and/or, isodecyl (meth)acrylate, lauryl (meth)acrylate, 2-(2-ethoxyethoxy) ethyl (meth)acrylate, tridecyl (meth)acrylate, 2-phenoxyethyl (meth)acrylate, tetrahydrofurfuryl (meth)acrylate, and/or, as acrylic oligomers, and combinations thereof, and/or (ii) at least one acrylic oligomer chosen from the group consisting of: polyether (meth)acrylates, polyester (meth)acrylates, polyurethane (meth)acrylates, polycaprolactone (meth)acrylates, epoxy (meth)acrylates and (meth) acrylated acrylic copolymers.

16. ~~Coating~~ The coating composition as defined in one of Claims of Claim 12 to 14, characterized in that it is intended to be applied or is applied in the form of a coating on polar or non-polar substrates and comprises:

0.5 to 50% and preferably from 5 to 30% by weight of ~~microparticles as defined the micropart in one of Claims 1 to 7, bearing (meth)acrylate and/or maleate and/or fumarate and/or maleimide functions f2~~

Claim 1, having f2 functions selected from the group consisting of: (meth)acrylate, maleate, fumarate, maleimide and combinations thereof,

- 50 to 99.5% by weight of at least one monomer chosen from: isobornyl (meth)acrylate,

and/or

isodecyl (meth)acrylate or lauryl (meth)acrylate; or tridecyl (meth)acrylate,

- 0 to 5% by weight of a C₂-C₆ alkylene di(meth)acrylate

the percentages being chosen such that the total sum of the microparticles and monomers is equal to 100% by weight.

17. Ceating The coating composition according to Claim 16, characterized in that wherein:

the polar substrates are selected from the group consisting of: glass, steel, aluminum, silicon, polycarbonate, wood, glass fibres, carbon fibres, cellulose fibres, polyester or polyamide fibres;

- the non-polar substrates are selected from the group consisting of: polyolefins and more particularly polyethylene, polypropylene and ethylene/propylene copolymers with or without special surface treatment, and coatings of low surface tension.

18. Ceating The coating composition according to Claims of Claim 16 or 17, characterized in that it is applied to the substrate in the form of a thin film with a thickness of less than 100 microns, preferably less than 50 microns.

19. Composition according to Claim 12, characterized in that

19. The composition of Claim 12, wherein the said coating composition is a composition of an aqueous dispersion of a crosslinkable polymer, comprising reactive water-dispersible or water-soluble microparticles, which participate in the crosslinking.

20. The coating composition of Claim 9, wherein Coating composition according to one of Claims 9 to 12, characterized in that the said composition is a composition comprising epoxidized derivatives.

21. The coating composition of Claim 20, wherein the composition is crosslinkable Coating composition according to Claim 20, characterized in that it can undergo

crosslinking by UV radiation in the presence of a cationic photo-initiator and comprises microparticles bearing epoxy and/or hydroxyl functions fl.

22. Ceating composition according to Claim 20, characterized in that it can undergo crosslinking The coating composition of Claim 20, wherein the composition is crosslinkable by condensation reaction with at least one second

reactive component selected from the group consisting of: polyamines and/or carboxy functionalized or carboxylic anhydride-functionalized polymers or copolymers; and combinations thereof.

~~23. Coating~~ 23. The coating composition according to Claims of Claim 20 and 22, characterized in tha

crosslinked by condensation reaction, it comprises the composition comprising microparticles bearing ~~epoxy and/or hydroxyl and/or carboxyl and/or anhydride~~ having functions f1 and/or f2 selected from the group consisting of: epoxy; hydroxyl; carboxyl; anhydride; and combinations thereof.

24. The coating composition of Claim 9, wherein the composition comprises:

(i) 24. Coating composition according to one of Claims 9 to 12, characterized in that this composition comprises at least one reactive resin selected from the group consisting of: alkyds or, unsaturated polyesters or, saturated polyesters or polyamides or polyurethanes or polyureas and microparticles as defined in one of Claims 1 to 7, preferably comprising functions f1 and/or f2 that are reactive with at least one function borne by this or these reactive resin(s), polyamides, polyurethanes and polyureas and (ii) the microparticles of Claim 1.

25. Moulding composition according to Claims 9 to 11, characterized in that it comprises

25. The moulding composition of Claim 9 further comprising: (i) at least one reactive resin selected from the group consisting of: unsaturated polyesters, dicyclopentadiene resins, vinyl esters, epoxides and polyamines or polyurethanes and polyureas or polyurethane ureas and microparticles as defined in one of Claims 1 to 7, preferably comprising functions f1 and/or f2 that are reactive with at least one function borne by this or these reactive resin(s), polyamines,

polyurethanes, polyureas and polyurethane-ureas; and (ii) the microparticles of
Claim 1.

26. Moulding

26. The moulding composition according to Claim 25, characterized in that it
comprises further comprising inorganic and/or organic fillers and/or reinforcing
agents chosen from the group consisting of: glass fibres, glass mats, carbon fibres,
cellulose fibres, polyester or polyamide fibres. and polyamide fibres.

27. The coating composition of Claim 24 wherein the microparticles further
comprise functions f1 and/or f2 that are reactive with at least one function borne
by this or these reactive resin (s).

28. The moulding composition of Claim 25 wherein the microparticles further
comprise functions f1 and/or f2 that are reactive with at least one function borne
by this or these reactive resin (s).

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